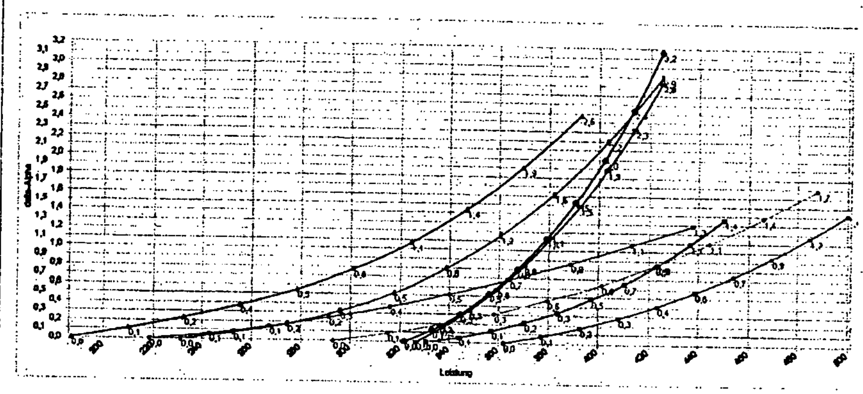

ISPCs

Individual Standard of Physical working Capacity

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Content

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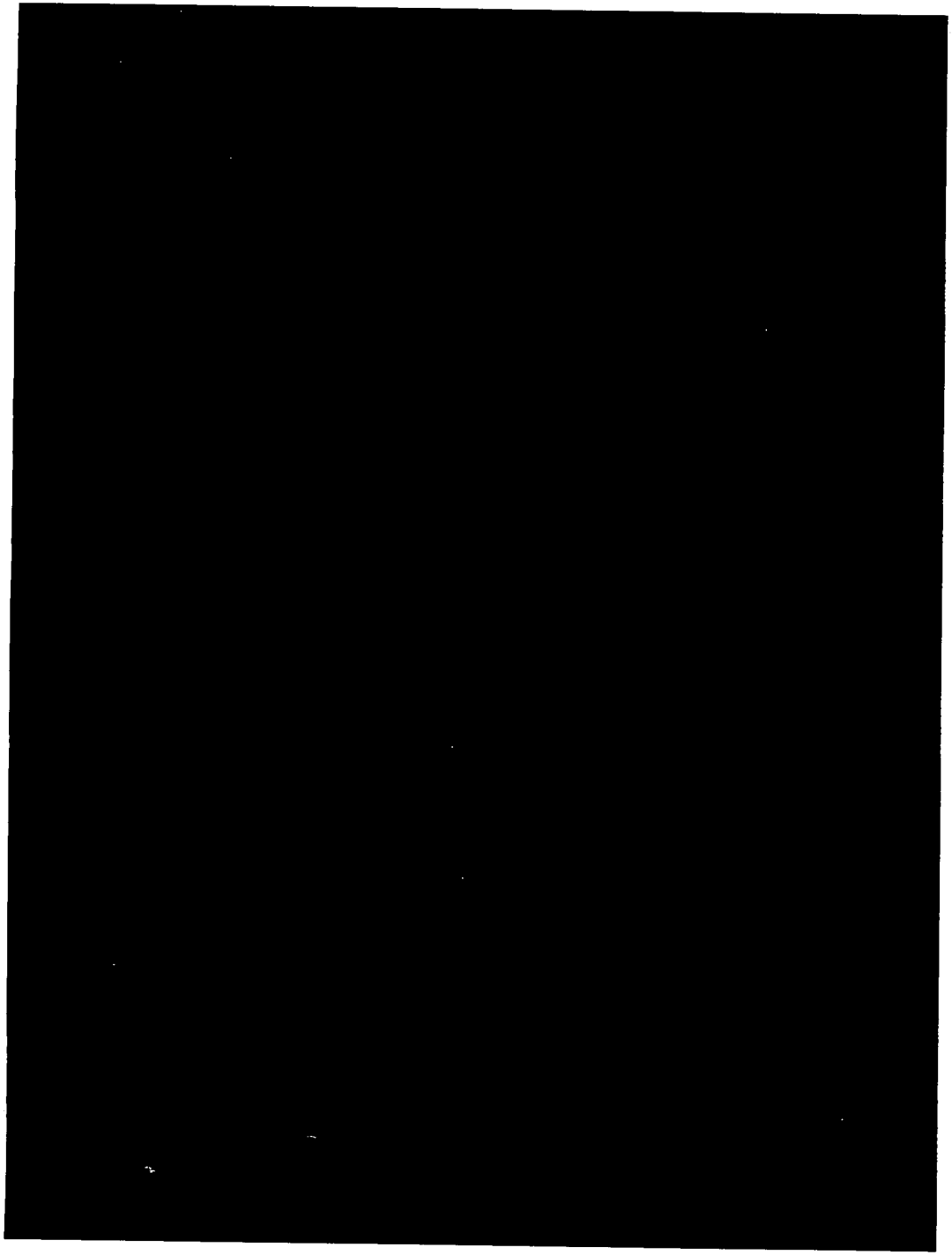

An international discussion amongst coaches at the beginning of 2004

On preparation for the Olympic Year a forum of coaches have discussed LAB EVALUATIONS and COMPETITION RESULTS on the internet. They are very disappointed concerning the so called THRESHOLD CONCEPTS because of their low prognostic value in regard to competition results. Amongst those "disappointing" methods the lATs (INDIVIDUAL ANAEROBIC THRESHOLD according to Stegmann) is quoted.

The coaches are critical of the inflationary number of new and controversial "threshold"-concepts, which elicit entirely different results. Those results do generally differ from testing procedure to testing procedure and thus are not at all reproducible. The situation displays a Babylonian number of variables which are difficult to handle. Therefore they consider the individual "EVENT SPECIFIC FEELING" of an athlete's MLSS (max lactate steady state) as preferable.

The article ends with an example concerning a rowing 8oar boat:

From winning the world championship in 1994, there was a continuous decline to bronze medallists in 1995 and 5th (fifth) out of 6 (six) in the final Olympic race during competition results: Even though the results of lab-tests, especially the threshold results, had been considerably improved during this time . Unfortunately- there are no Gold medals available for "Lab Champions".

The critical remarks from coaches concerning the value of threshold concepts originated in 1996. In 1994 while serving as head of the Exercise Labs of Karl Corth Institut , I had already expressed concern about the incorrect use of the Threshold Concepts: In a press note from a pre- Olympic Congress in Lugano the "Hamburg Mannheimer Stiftung for Medical Information" informed about the practical consequences of those new investigations. All those Exercise Physiologists who were, and still are, responsible in coaching institutions were attending. Although there were some controversial opinions, there was no discussion about the results.

Our claims, the coaches and mine, are scientific totally correct: Reproducibility of testing results must be of primary consideration. If all testing procedures available are tested according to this basic condition only one testing procedure will prevail. And as by magical power the babylonian number of variables will disappear. Nevertheless we still would not win much because an exact reproducible determination of the threshold capabilities may still result in bad results in rowing competitions.

Improvement only can be achieved by:

1) *Adapting testing procedures to specific loads equalling the effort in specific events*

   and

2) *A comfortable computer program that adopts itself to complex kinetic interactions as well as to combinations of time , volume and flow rates*

Lactate Kinetics and the In[illegible]ndard of Physical working Capacity

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ATHINA 2004

Introduction

Keywords: IAT,"Stegmann"-threshold, lactate shuttle kinetics, ISPC

The Individual Anaerobic threshold (IAT), also called the "Stegmann threshold" has become a widely accepted method for endurance testing as well as for endurance coaching purposes since decades now [1,2,3] despite ever since there have been numerous attempts to present preferable methods.

New investigations [4,5,6] raise objections to the assumption of an anaerobic origine of lactate occurrence. This is in accordance with lactate kinetic in blood [7] which is independent of O2-uptake.

Methods

Stepwise incremental exercise of 50 Watts per working step is used. Working time per working step is varied from test to test between 15 '' and 30 ' to exhaustion. Results are investigated by a new method being deduced from the lactate kinetics model [1] which shall be as reliable, reproducible and valid as the IAT has been proven to be[2].

Results

In one Individual all those different testing procedures depict one single curve , which is defined as the ISPC "Individual Standard of Physical Capacity "and in one single WL for IAT. O2-uptake is less than ¼ during short step exercise compared with long step exercise at identical load. Lactate kinetics are identical at identical loads..

The ISPC predetermines working time during rectangular exercise above the IAT more exactly than delta WL (work load) above the IAT (absolute and % IAT) [2]. Sophisticated computerized testing and interpretation modules only are able to prevent from false assumptions [9].

The relevance of the ISPC is dicussed in a group of 8 (eight) top scoring athletes horizontally as well as vertically during the training process.

Discussion

Experimental evidence proves : there is only one IAT which is defined by a certain WL independently of testing procedures [see also 10,11].

There is only one ISPC (Individual Standard of Physical Capacity) which defines the ability to sustain a certain work load for a certain working time (which again predetermines the type of event) independently of O2- uptake during testing procedures.

Results throw doupts upon all those theories of "aerobic", "lactacid anaerobic", and "alactacide anaerobic" energy provision at one side and upon "power training" vs. "endurance training" at the other. They seem to be –more or less- the other side only of the same coin.

A computerized testing and interpretation Programm is presented which shall help to care for equal opportunities within the community of male and female athletes.

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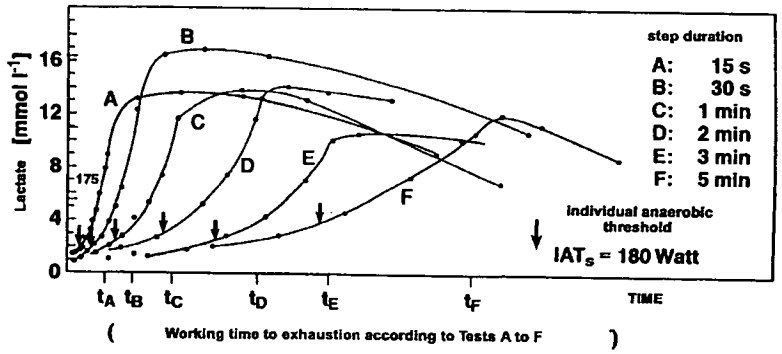
Acknowledgments

I thank my family members for their patience, those who ever were involved in the developing process for their initiative and George for his friedly support.

The Computer Program

The KINETICS OF METABOLISM can be made available for diagnostic purposes by a computer program. Using this approach each individual can benefit immediately from investigations which have been presented above .
The most important feature the coaches have been asking for was "reproducibility".



Lactate kinetics during stepwise increasing exercise. Working time per working step (50 Watts), varying between 15" (700Watts finally) and 5' (250 Watts finally) in physical education students.

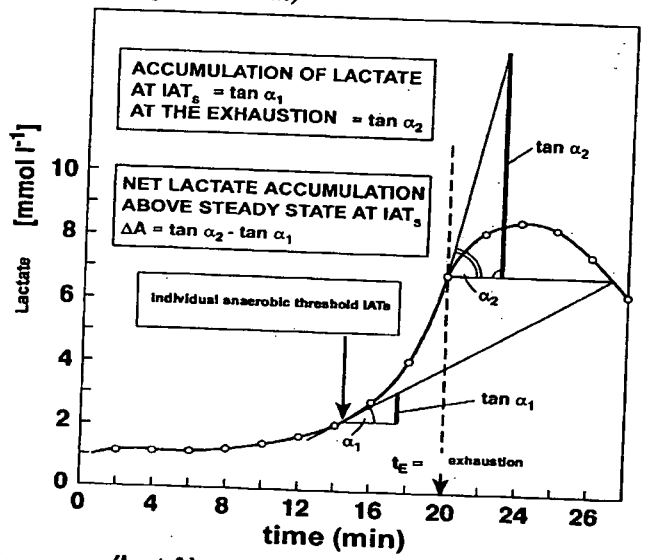
Diagram 1

As shown in Diagram 1, the Individual Anaerobic Threshold (IATs) provides the only reliable method which is independent of testing method. This had been confirmed by Heck, Weicker and Kullmer already, using exercise variability from 2-5min steps while gradually increasing work load, We extended variance of the working time per working step from 3" to 30' at workload increments of 50 watts. The computer program always displays the IATs very closely in all tests with an almost identical workload. However, because of system related reasons, the 1'-5' tests determine the IATs most accurately (Diagram 1)
Whereas an identical work load is determined at the IATs, lactate concentration and inclination of the lactate curve does vary grossly. This inevitably questions the other methods available which all have been proven not to be dependent of testing procedures. This counts especially for a "new" definition of an "Individual Anaerobic Threshold" determining the IATs at 1mmol/l lactate above the base line lactate level ,although this term had been used since 1981 for the original method. An increase of 1 mmol/l during a 15"Test would be equal to 4 mmol/l during a 1' Test !
From the point of view of reproducibility there is no lactate threshold more trustworthy than the IATs as it still is.

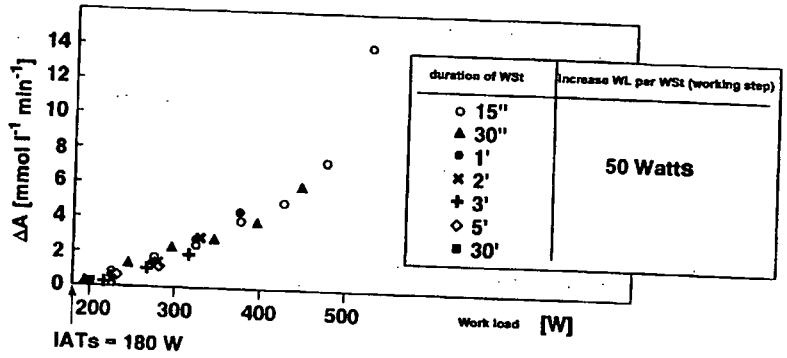
Though this is not enough to meet demands of coaches:

Detection of the ISPC

By testing lactate kinetics (dA) above the lactate steady state (diagram 2), the ISPC (individual standard of physical capacity) has been detected (diagram 3) : (corrected according to Vm/Vb ratio)



(L, ΔA) - accumulation of lactate above the ILts (corrected for Vm/Vb)



ΔA **IATs (ILTs) - corrected rate of lactate accumulation**
L **Work load during stepwise exercise to exhaustion**
IATs **Ind.anaerobic(lactate threshold)(Stegmann et al., 1981)**

diagrams 2 and 3

This standard not only defines the "old" IATs (0-point)- but it defines also the total working capacity being investigated above this WL (work load). However, if one wants to mirror specific capabilities taking certain events into consideration, it is necessary to run totally new, event specific procedures.
The ISPC has been shown to be an as reproducible and reliable a method as is the IATs.

In contrary to lactate kinetics, O2-uptake,(and heart rate) are not at all related to work load (diagram 4). At identical WL with max O2-uptake during a stepwise (50W/3') exercise test lactate kinetics are identical with rapid-increment tests (15''/50W and 3''/50Wresp.). The O2-uptake however is less than 30% during the rapid-increment exercise test. Lactate kinetics herewith define and as such predetermine individual working capacity- whether O2-uptake was high or extraordinary low.

It becomes obvious, that lactate kinetics are neither aerobic nor anaerobic.
They are entirely par aerobic. Thus we should not speak of an "Individual anaerobic threshold", IATs, any more but rather of an "Individual lactate threshold" :ILTs

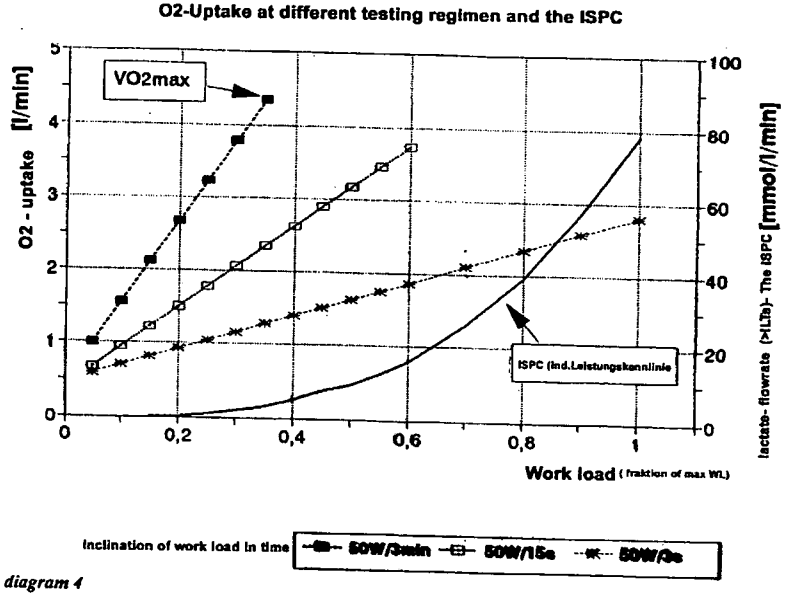


diagram 4

Though this is still not enough to meet demands of coaches

These demands can only be met by another detection:
The variable Ax, which determines the ISPC curve, correlates more closely to the potential of power output (working time to exhaustion), than classical parameters do, p.e. there are "WL" or even "dWL above the IATs". (see diagram 5 and 6)

Thus Ax/Lx obtained by a stepwise exercise test defines a certain Wt (working time in a rectangular field test). And Wt is defined by certain event-specific conditions: (world)-record –time, duration of contest or duration of rounds. One ISPC curve predetermines infinite rectangular tests (event-specific capacities). Whether the specific event in question is covered depends on the testing procedure.

In the future it should be looked upon as obsolete driving conclusions concerning rowing competitions from ILTs –measurements (apart from "touring"-championships). Most other events in sports are concerned too, because they are not performed as endurance contests.

X-Axis : dA-values obtained from a stepwise exercise test to exhaustion
Y-Axis : rectangular time to exhaustion at the WL

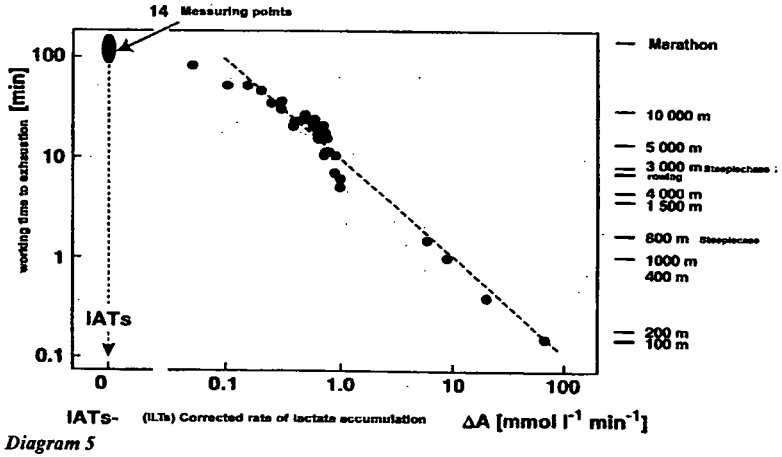


Diagram 5

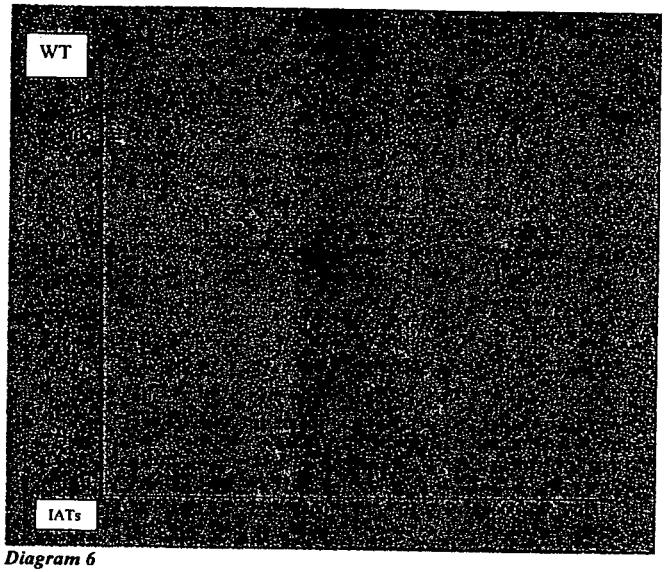


Diagram 6

In general one is interested in a certain discipline, a distinctive work load (Lx) at a certain point (Ax) of the individual Lactate/Load curve (ISPC). The shape of the curve can be investigated during different coaching phases. Comparing curves of different athletes shows different capabilities. One will find out not only the "what" (they do) but also the "how to". This opens information about perspectives of training. An especially preferable feature of prognostic value is an observation of a slow increase in dA during a big increase in WL (dLx). The opposite constellation would be less preferable.

The IATs has been very much overvalued by fellow physiologists in the past, for it cannot provide information which it has not been developed for: i.e. "loads above the endurance competition". Thus for coaching in competitive sports it is of minor value generally.
If weight loss, general fitness and basic endurance workout are focussed, the IATs is of extraordinary significance, especially in patients with coronary artery disease and patients at risk (diabetics included).
Despite endurance competition, as far as high scoring top athletes are concerned, the IATs "work load regimen" should be looked upon merely as "everyday homework-intensity".

Examples

A group of 8 rowers during different testing phases

The year in advance of the Olympic year	—— *blue*
The Olympic year	----- *red*
The year after the Olympic year	----- *green*

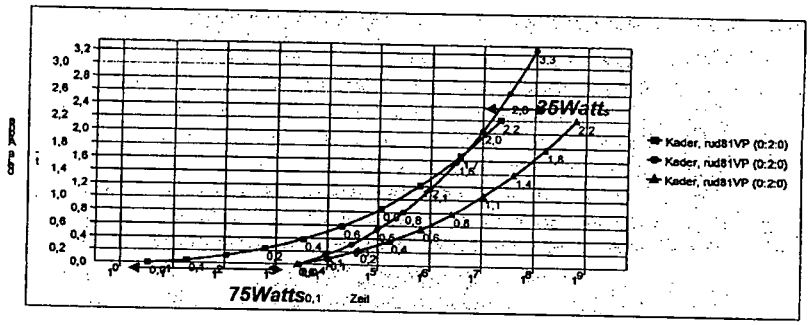


Diagram 7

As far as pre- Olympic and Olympic year curves are concerned there is a distinctive increase in work loads (Lx) at identical physiological stress (dAx) during Olympic preparation . As far as the mean rowing specific capability is concerned (Ax 1,2-1,7) the increase in WL between the blue curve and the red curve is 425 to 460 = 35 Watts only, whereas the increase at the IATs is 260 to 335 = 75 Watts.

This is quite strange, if one considers high intensity "contest– specific" coaching efforts: Those guys have made the double amount of progress in "touring"-rowing than in race-rowing for the Olympic Contest. Has this been caused by pressure on the athletes to be nominated for a certain boat by means of a high IATs?? This could indeed make the not tested , hard rowing guys prevail over those with a high IATs. Or, with other words, IATs-world- Champions might have been rowing behind, because the rowing distance had not been long enough. They would have needed a competition time of up to 2 hours to show their very special capabilities.

Especially impressive becomes the green curve of the post- Olympic year: endurance training may have conditioned athletes so strongly that they remained so: the

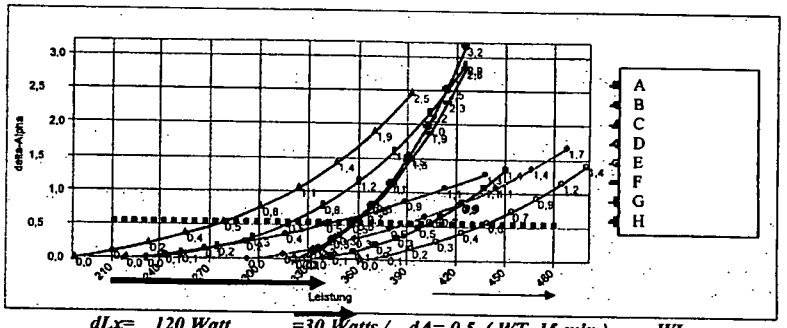
IATs- was still unchanged at a very high level. This "excellent conditioning" was used to categorize for promoting and funding purposes. Note that the rowing –specific capacity had decreased even behind that of the pre- Olympic year (from 465 to 425 = 40 Watts). Therefore could it be that categorizing athletes by IATs for promoting purposes manipulates training modalities away from rowing specific training ?

If one compares pre – and post – Olympic results one will immediately understand why coaches in the US were disappointed by contemporary testing procedures:
During this 2 years of training there had been an extraordinary increase in IATs load (by 75 Watts/ 33%), whereas rowing specific capacity decreased even behind the pre – Olympic value. This is totally in accordance with observations made by this group of coaches in the US.

ISPC- The Individual Standard of Physical Capacity

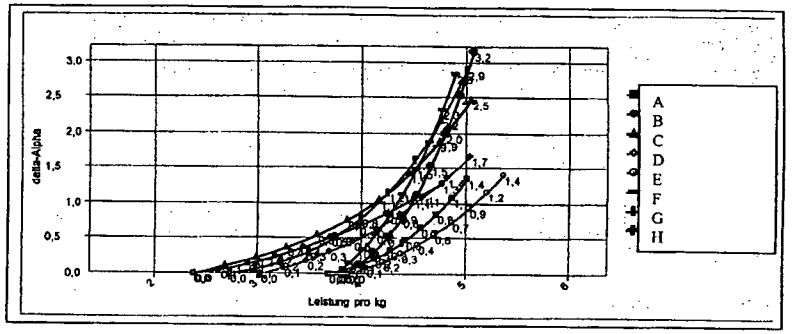
Curves using "mean values of a group of athletes" are of no value for the single athlete and for coaching purposes. So now that you now know what they can tell you, forget them because:
The single athlete is our focus and our destination
The single athlete has one Individual Standard Line of Physical Capacity (ISPC), which is distinctively different from any other athlete.
The following graph shows the ISPC-lines of eight rowing athletes during the

Pre- Olympic year (Diagram 8/9)



dLx= 120 Watt =30 Watts / dA= 0,5 (WT 15 min) WL

Diagram 8



WL/kg

Diagram 9

And the Olympic year (Diagram 10/11)

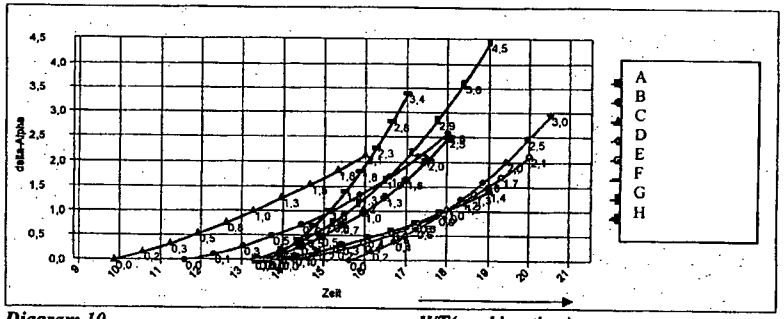


Diagram 10

WT(working time)

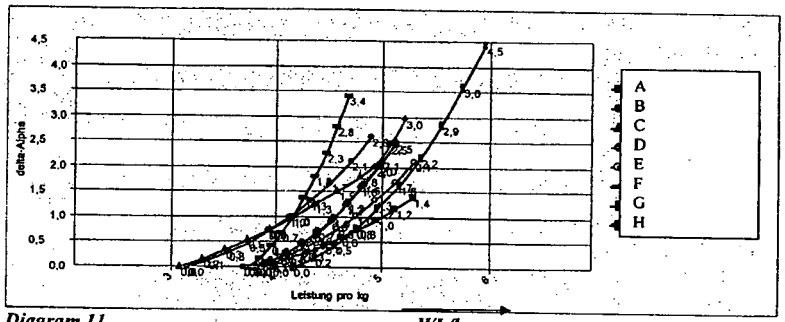


Diagram 11 *WL/kg*

There is a totally individual shape of those lines :

1. ***Steep or gradual inclinations of the curves***
2. ***Curves that derive from high and less high IATs (0-levels)***
3. ***Curves, that show intersections with other curves***

The x- variable displays the work load Lx (Watts, Speed), the y- variable defines working potential (max possible working time) by Ax/Lx interrelationship. Very distinctive individual working capacities can be determined and compared vertically and horizontally. Different shapes of the curves show very different capabilities
Concerning the window of observation, which is dependent on the experimental design, note the following:

1) Slow inclinations of dA generally indicate a generally more constant working capacity within the investigated area, which is advantageous if a broad variability of sportive effort is asked for. Improvement of basic conditioning (IATs) is easier too if inclination above the IATs value is low.

2) Steep curves define more or less a small area of working capacity, indicating a more specific conditioning within this area of effort.

Different values at the starting point of the curves (0-Punkt/ILTs) indicate a more or less high basal conditioning.

All the investigations concerning the validity of the IATs in determination of the MIASS (maximal lactate steady state) were performed with WL (work loads) exceeding the work load at the IATs +5% and +10% respectively, in a rectangular test to exhaustion. This led to "surprisingly" different working times. From the lactate kinetics model point of view one should rather have taken loads at identical dA values. At identical dA one will apply identical physiological stress on the athlete (diagram 5). Such, the probability to obtain identical working time to exhaustion will be much higher . The example in diagram 8 displays at dA=0,5 the extremes of dWL of 35 Watts (+10% IATs) and 125 Watts (+50% IATs) respectively!!

Especially challenging are the intersecting points of the curves, because there the score of working capacity of athletes inverses: Those, who had a higher working capacity below the intersection point show markedly lower working capacity above the intersection point.

Discussing different ISPC - dA at inclination of running speed

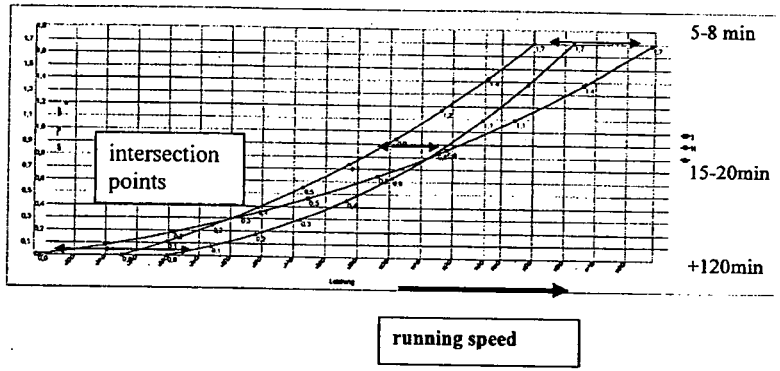


Diagram 12

Differences may predetermine success in competitive sports:

Single Sports- Running

Three athletes according to the above standards will perform during the contest according to their very specific capabilities, actual working intensity dA (time to exhaustion) and tactics during the contests.

If it were not a tactical race, and everybody would act according to their individual capabilities, a marathon contest would be dominated clearly by the athlete with the highest IATs (red line) beating the athlete with the green line by a distance similar to that between him and the "blue athlete".

At a "potential" racing distance of ca 8000 m the "blue" and the "red" athletes would be very close at the end of the race, whereas the green athlete would be clearly outdistanced.

Running distances at ca. 3000-4000m would be significantly dominated by the blue athlete, with "red" and "green" coming in second and third respectively.

Furthermore during tactical races, at an initially slow running speed, the "blue" athlete may have a winning- chance over the other athletes even at the long distance race.

Team Sports

Soccer

Given players of a soccer team possess specific working capabilities according to the ISPCs in the following diagram:

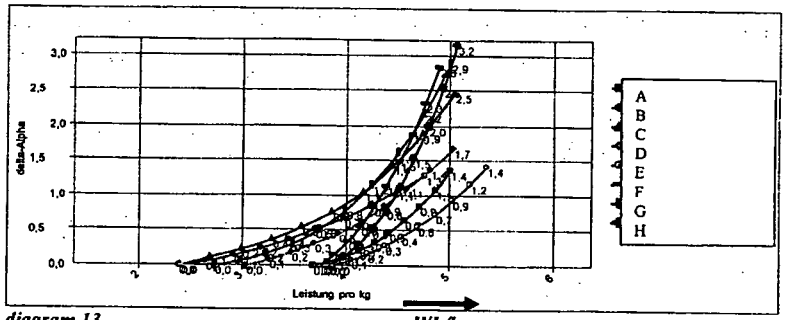


diagram 13

WL/kg

The above team consists of players with specific capacities which enable them to succeed under different conditions.
Basically one must divide the team into one group of four players with a relatively low endurance capacity, (2.5 and 3Watts/kg), and a second group with a relative high endurance capacity, (3.7 and 4Watts/kg). This "endurance capacity" may play a part if a game is performed at a overall high tempo. If the high endurance group would run the whole game near to or slightly above their endurance capacity (IATs, ILTs), they would outperform the less endurance trained group, which would be exhausted after about 15min.

However, there are important differences within the groups:
As far as the less endurance trained players are concerned there are two athletes displaying a more gradual inclination of the ISPC compared to the remainder. A similar observation can be made in the highly endurance trained group. Here again, two players display a more steep and the other two a more gradual inclination.

Classification of an "internationally acknowledged player" to a ISPC- type is by assumption only, because of their special behaviour on the playing field :
A steep curve at a high endurance capacity indicates a more specific capability which should be a feature of offensive defenders. Tasks such as disturbing the game of the opponents, shadowing a striker or performing counterattacks while seeking superiority in number and eventually even scoring, do ask for a very high endurance capacityH,F (Ziege, Breitner,Vogst, Beckenbauer, Augenthaler) .

However, exhaustive exercise between 30-15 min causes an entirely new evaluation:
The "yellow" D (Ronaldo, D.Hoeness, Seeler, Völler) and even the less endurance trained "green"B (Bierhoff, Mueller,) players are the only ones who are able to challenge the "dark blue, A (Sammer, Mathaeus, U. Hoeness,), and the outstanding "bright blue" player E (Cruiff, Zidane at his best).
However, active recovery of the less well conditioned players is possible only at a much lower intensity level than the highly endurance trained players.

If a coach does not know the specific capability of the above players, he may wonder about "strange" or "mystical" turning-points in the game, when certain players suddenly take over , disappearing from the stage for some time and then coming back again. Other players may dominate the entire course of the game, though finally they may fail, because the crucial (scoring) moments are on the side of the less endurance trained, high intensity players.

Even though the above features do cover an important part of the game, the outstanding sprinting capabilities of e.g. Seeler, Müller, Bierhoff, Ronaldo, Ronaldhino etc., have not been tested by the ISPCs- spectrum above. Sprint capacities need the extended ISPCs testing procedure as described later on. If this extended test would have been performed on the above group, the player B and the player D probably would have turned out to be even superior to player A and even the outstanding player E, though this has not been investigated and is only speculative.

Given there were three football teams with a "blue", "green" and "red" capability

(despite all those limitations, "mean" evaluations do have in respect to the "individual" point of view, an analogue to the Olympic rowing preparation will be discussed)

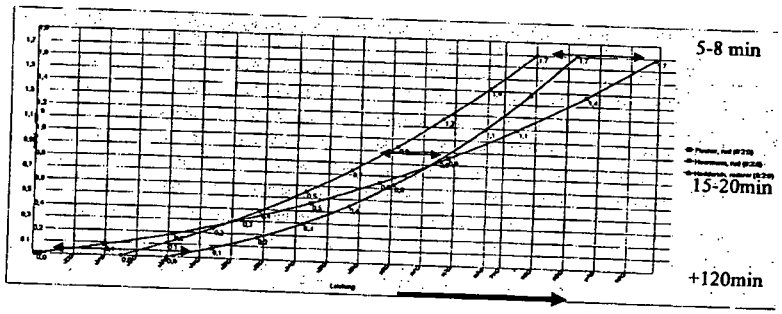


diagram14
In the case of a typical "running game" with early "pressing and defending" in the opponents half, a team with a working capacity resembling the red line will generally succeed over a team with green or blue-curve capacity. Especially during tournaments, when one game follows the other closely, a team with a generally high endurance performance profile will prevail.

However, success will also depend on tactics:

If there were a team with an overall working capacity resembling the green line including a group of 3-4 athletes with "blue line" capability, there could be the following tactical procedure against the "red" team:

At the beginning of the game, the "green group" adopts the work intensity of the "red group", and because of the outstanding fitness of a red group, the green group should organize merely a "area- defence system", not shadowing each opponent. It is extremely important that the "blue" players within this team should be allowed to conserve energy during the initial stage of the game. While during the course of the game, the better conditioned " red team" seems to take over, the "blue athletes" should suddenly start an attack according to their specific extra high working capacity for 8-10min. These athletes are introduced into the game by their "green team members" at every possibility. Though, they preferably search one another. And – by their extraordinary working capacity- they will be able to overpower the red team, which may feel k.o. at the least.

The blue group will also feel somewhat exhausted, but they will recover much quicker, while the green athletes will have some time to recover during the attack. Under these circumstances, the better conditioned red team is the most vulnerable. And if these attacks are performed again and again during the course of the game, the mixed team may prevail over the better conditioned red team.

What about a team consisting exclusively of "blue" athletes, all with high-intensity capacity?
A team consists of 11 players and if 3 of them perform a high-intensity interval speed, the other athletes may, if they are technically well trained, be able to relax by "letting the ball run". After 10-12 minutes, three others take over, allowing the remainder to move more economically. If this team is able to keep up this high-intensity level game, they will be able to overpower all other teams which are not specially trained for these high- intensity loads.

If an athlete belonging to the "blue group" is not diagnosed properly , and he is given "red" tasks during a game, he might turn out as a failure similar to the other ones , whose "red" capacity have not been established and are given "blue" tasks. Considering the individual standards of physical capacity, all those athletes have been coached – more or less – the same way. Although, the curves show strong differences in shape they are doing all the same, however "how" they do it is entirely different.

If one takes a soccer team, one will receive similar as well as different curves. Knowing the outstanding working capacity of athletes, one will be able to introduce this knowledge into the tactical planning of a soccer game, bringing the athlete into the game according to his specific capabilities without exerting him beyond his own, individual performance capability. In the case of injuries, or a decrease in conditioning, one will know exactly how long an athlete will be able to perform at a certain working intensity.

Improvement can be planned in accordance with the knowledge of what is quickly possible, and what needs time and caution thus not reducing important qualities, as has been shown above with the rowers.

Bike - races

Given a team of 8 racing cyclists (assumption: same body weight)

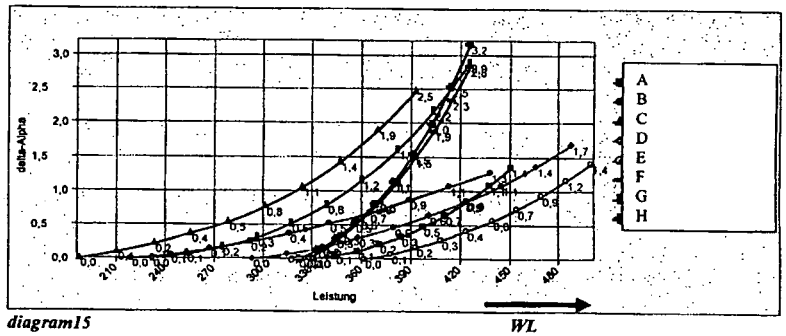


diagram15 *WL*

There are two groups within this team of 8 cyclists:
a)There are three athletes with a relatively low endurance capacity (load IATs between 190 and 230 Watts) and
b) 5 cyclists with high endurance capacities –IATs between 290- 360 Watts .
During a team contest lasting p.e. 1-2 hours the fife high endurance athletes b) would be equally able to contribute to the success of the team.
Out of the group of 3 athletes with low endurance a), only athlete B, (green line), is able to contribute significantly to the benefit of the team, despite his relatively low endurance capacity (ILTs/IATs). If he were used as pacemaker at the beginning of the race, he could maintain a work load greater than 330 Watts for a period of 30-35 min before retiring into the main body of racers because of his lack in endurance capacity.

If the "speed train" of those fife cyclists were working together, athlete E, (light blue) would take over most of the work (IATs 360 Watts, highest speed competence), followed by athlete A, (dark blue) with the second highest endurance capacity and a very high speed competence too. A forth cyclist (D, yellow), who like cyclist B discussed above, possesses slightly lower endurance capacity than his group mates, but a high speed competence, would assist significantly. These 2 cyclists, (B and D), will be discussed in more detail:

cyclist D, similar to cyclist B, will at high workloads (speed increase or sudden work increase that can be sustained for 8-30min) approach the outstanding capacity of cyclist E, (light blue).The shape of the line suggests, that extension of the test to even higher working capacities (see beneath) would result in similar, if not better conditioning of the two cyclists B and D compared to the top cyclist E. Since we however did not conduct this test, we do not know.

After contributing to the speed of the team by front running, cyclist D would not disappear like cyclist B, but because his endurance capacity is only slightly lower than the mean of the top cyclists ,he would easily recover behind the group of better endurance-

trained individuals. After recovery, which will take some time, he would be ready to challenge even the "top" cyclist E. If Cyclist D and E belonged to competing teams, the outstanding athlete E (p.e. Armstrong) could only be beaten by athlete D, e.g. Ulrich. Only cyclists with this capability would be able to contest Armstrong in high intensity, high speed races. This would be advantageous, if athletes like cyclist A, dark blue, e.g. Beloki, and athlete B, green, e.g. Zabel, would launch high- speed, high-load attacks prior to the final attack of the yellow athlete D.

All those working capacities are the result of physical training, and- as has been shown initially by the rowing preparation for the Olympics Games- they can be eventually modulated to the advantage or disadvantage of the athlete. One has to be careful, not to lose important capabilities of an athlete on the one hand by improving less important capability on the other hand.

It is essential that a coach does know what the athletes he is training are able to perform.- best by knowing the extended working capacity tests described later

Boxing

As a fight does last 12 rounds, each of 3 minutes, then the whole contest takes 36 min. If pauses between rounds are taken into account, the basal over all intensity assembles a load –using classical aspects of exercise physiology – the VO2max -using lactate kinetics, dA of 0,8-1,3. High loads at this "capability" will be of extraordinary importance in order to "move" quickly, thus preventing oneself being hit by the opponent or placing oneself in a good position to counter- attack .

Though, this capability will not be enough to beat a combatant, or even knock out somebody. During in-fighting, clinching with an opponent, speedy body motion to fight back or to prevent oneself from being caught is more akin to sprinting or weightlifting contests, where high intensity dA are required. To evaluate these capabilities, the extended standard of physical capacity curve (below) has to be established in each boxer.

Determination of the ISPC (Individual Standard of Physical Capacity) covering an extraordinary broad area of physical Capacity.

Lactate flow rates dA, exceeding the flow rate at the IATs: (physical education students) *see diagram1*

dA at exhaustive exercise tests between 15'' and 30' duration of working steps and 50 Watts increase in WL at each step

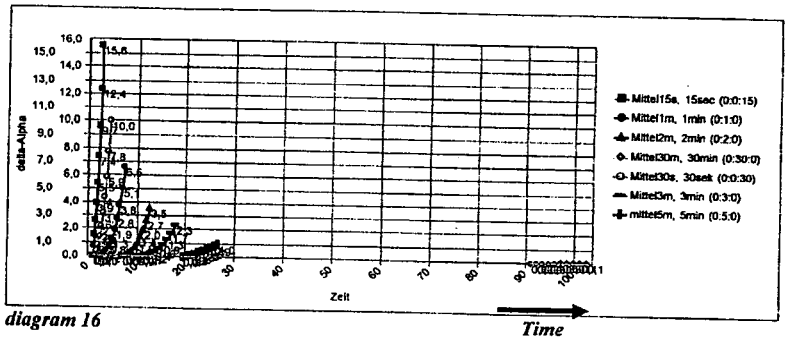


diagram 16

Time

If one wants to investigate an extended spectrum of physical capacity for an individual one may combine the exercise tests discussed previously. If one presents tests with different WT (15"-30') at WL steps (50 Watts) according to WL, one will obtain a group of curves which run very close (if corrected for Vm/Vb ratio), though it is difficult to evaluate a bundle of curves:

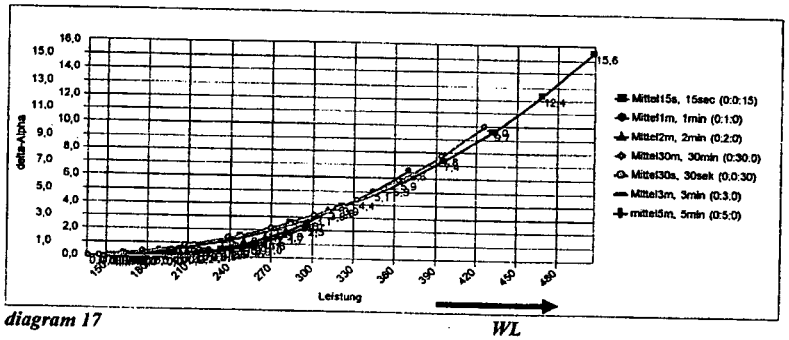


diagram 17

WL

On the other hand, it is possible to combine two, a short (15") and a long (3') test to exhaustion, receiving a dAx/Lx potential of an extended spectrum of physical activity.

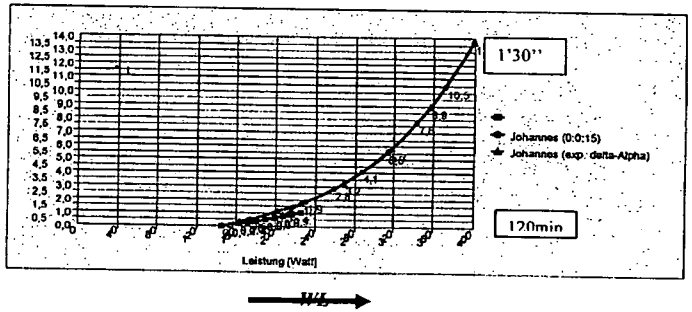


diagram 18

This method allows to investigate the broad spectrum of physical activity from a 100 m run to the endurance marathon contests on a single curve, if experimental conditions are adopted properly. These experimental conditions are challenging, but it can be done as we proved in 10 decathlon athletes.

Determination of this broad spectrum of physical capacity asks for complicated model adaptations as provided by our computer program .

Determination of this extended curve of physical capacity demonstrates the "highest"- standard of the exercise- physiological diagnostic program.

Proposal

Together with this entirely new physiological model a number of new detections have been introduced into the scientific discussion. In consequence there is no comparable method available world-wide. In order to adapt different types of physical exercise to the computer model a number of nomograms and mathematical constants had to be created, and others will still have to be established by experiment.

However, one will easily anticipate by the ISPCs-curves shown above, how significantly this new model does contribute to exercise physiology already.

As far as lactate kinetics are concerned there has been hardly any progress since the detection of the IATs in 1981 which is now, again, confirmed by the above model. Not even the "quality control" by performing WL at IATs + 5%,+10% with endurance exercise tests has been up to the quality standard of the lactate kinetics model (diagram 8). Objections of fellow physiologists that the IATs "cannot be determined in some cases", will easily be refuted by the above experimental data.
Obviously, within the last 20 years further development of this model could not be assimilated easily from outside. And as there is still some scientific work to be done, it is too early to offer you a coaching/ training packet for the computer program. Furthermore because of the complexity of the model quality-control, developing standardisation and updating purposes supervision should stay in our hands.

Therefore we are glad to offer you either

1) *the investigation of your athletes at our facilities according to the above methods, also a thorough internal medical investigation may be included, (cardiac ultrasound, X-ray, nutrition plan, etc),*

   or

2) *The creation of a physical coaching centre up to our standards (see above) at a site of your preference, which will be supervised by us for quality-control and development purposes (up-dates, experimental and hard-ware-integration) with you on" standby" if problems arise*

We look forward to hearing your opinions and ideas about the above proposal

Yours sincerely

Heiner Stegmann

Dear Coaches,

For decades you have been using the IATs -methodology (individual anaerobic threshold), which has been proven to be a confidential method for endurance prognoses. Ever since the 80^{is} there have been various attempts to improve –or indeed, just to match- the precision of this method by "less complicated " and /or "more economical" ones. Nevertheless the IATs did prevail. However, nowadays there is a broad discussion about the significance of the IATs in coaching, especially of its validity in respect of prognoses in contests.

I am, as well as many coaches are, concerned that the IATs had been used in a more universal way than is appropriate: No testing method is able to present information beyond its experimental borders. Per definition the Lactate Steady State covers the endurance capacity only. Thus the significance of the IATs is very limited in respect to coaching purposes. It only defines a certain constellation in the " lactate / work load diagram" at which the athlete is able to sustain work for approximately 2h [110'] (without supplementation of food and drink)

As far as we know now, there is hardly any connection to O2-uptake and thus the terminus has not been chosen correctly. One should rather name it the ILTs (The Individual Lactate Threshold) as it is defined by lactate kinetics only.

Concisely expressed : The ILTs (IATs) is indeed an exact measure of basal endurance capability and thus a measure of training effort and training volume in a specific athlete, but it is of no use for event specific prognoses in competition. It is therefore of minor relevance for coaching purposes as well. But this is what is exactly provided by the "ISPC" (Individual Standard of Physical Capacity) which has been presented at the pre - Olympic IOC-World Congress 1993 in Athens where it received great attention.

The main scientific interest was focussed on the presentation of the evidence of a physiological model.

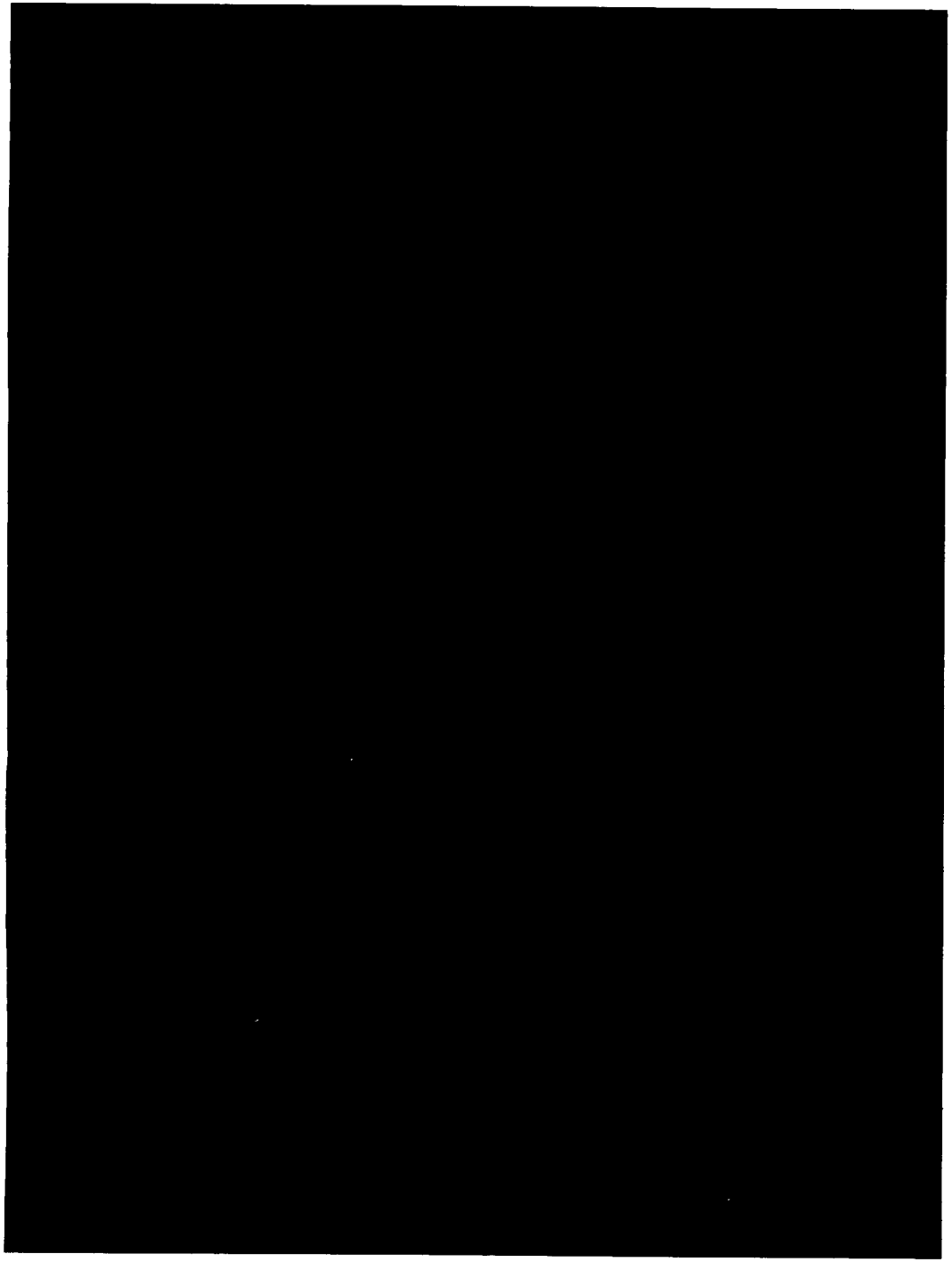
Nevertheless there was a remarkable interest from coaches as well: Interest was focussed on the Computer Program which was presented simultaneously. Significantly athletes can be investigated according to their entire event specific working capacity by means of their individual ISPC. This gives information about good/less good prospects of athletes, how to improve their chances, improve their strength and overcome their weaknesses in relation to other athletes. Horizontal and vertical investigations will show the benefit of coaching efforts in groups of athletes during the preparation phase before contests, providing information not only about the "What" but about the "How to".

Summary

Evidently the IATs has been overvalued by exercise physiologists. However, an understanding of all the underlying circumstances would have required ongoing investigation and consideration to elicit the requested, preferable method (ISPC).

Although in 1981, I invented the IATs, I never considered it as a universal tool and I warned in 1994 when I served as head of exercise laboratories at KCI, Erlangen not to overstrain this method in its relevance for coaching. In a press campaign "coaches better than their reputation" the contribution of coaches to the success in athletes has been scored far beyond those of exercise physiologists.

whereas the ILTs/ IATs defines only one point (0-point), the ISPC-curve defines, if experimental conditions are met, a spectrum from 100 m run up to marathon running performance. This method for the first time will provide a benefit for coaches, as it contains additional information that reaches far beyond their experience. Athletic competence



according to the ISPC is a very variable complex – even if a "homogenous" group of athletes are investigated. Results of athletic contests are predictable- if at all- under certain conditions only, and conditions do vary strongly. Knowing the ISPCs, athletic performance will become less a mystique and much easier to interpret. Coaches and athletes will have more knowledge to work with and can anticipate better performance.

However, by the way, one might get some idea about the underlying mechanism , which transforms former top athletes into extraordinary good coaches (Beckenbauer, Stieleke, Völler, Voigts, Hrubesch, Magath, Augenthaler, Mathäus, Sammer etc). Great players have been both, object and subject, when experiencing all kinds of "specific capabilities" during their career.

Dr. med. Heiner Stegmann

Born in 1945. Basal certificate from city council trainee seminar Wiesbaden 1964. High school degree (Abitur) in 1966. Call up for military service to parachute -btl. at Lebach until 1968, Lectures in English literature, pedagogical psychology und physical exercise at Frankfurt/Main und Mainz. First degree examination in physical education (Diplomsportlehrer) in 1971. Graduation from medical school after third and final medical examination in 1977. Promotion 1978. Post doc at Diakonissen Krankenhaus Frankfurt, Sportmedizinisches Institut Saarbrücken, University Erlangen und Waldkrankenhaus Erlangen. From 1989 Office Internal Medicine, main focus on cardiology, vascular disease and diabetes in 63450 Hanau.

Sportanamneses:

From 1950 regional contests in gymnastics and handball.
From 1963 regional und national championships in „German" decathlon (Gymnastics and track and field sports).
1966-68 first place in soldiers sport contest during service at Fallschirmjäger Btl.4/261 at Lebach , member of the succeeding handball team.
1968-71 Lectures in sports and physical exercise at University Frankfurt/Main and Mainz, "Diplomsportlehrer" exam at Mainz
1971-77 Coach and teacher in physical education and exercise, financing medical school .
1981-1982 Dpt. sports- and physical exercise University Saarbrücken: p. e. detection of the IATs.
1983-1989 Head , Dpt. physical exercise laboratories Karl Corth Institute, Erlangen
1989-2003 integration of newly developed physiologic testing procedures according to kinetics of metabolism into medicine, p .e. detecting the ISPCs and related subjects, kinetics of lactate- and BS- metabolism, kinetics in hormones and respiratory parameters. Evaluation by computer programs. Foundation and active support of free rehabilitation groups for CAD, mentally disabled and cancer patients.
2003 „golden certificate" of the "German Council for Sports in the Disabled" .
Foundation of HSI (Health Standard International) Oregon/Hanau.